The law enunciated above may also be stated in the following form.

The increment of each unit of chemical change due to a rise of temperature varies as the increment of each unit of absolute temperature.

This law is expressed by the formula

$$D\alpha/\alpha = m\mathrm{DT}/\mathrm{T}.$$

Chemical Equilibrium.

A case of equilibrium between the reactions

$$H^2O^2 + 2HI = 2H^2O + I^2,$$
$$2H^2O + I^2 = H^2O^2 + 2HI,$$

leads to a discussion of the general equations of chemical equilibrium which is given in an appendix to the paper. These equations are employed to interpret the results of experiments published by Dr. Gladstone in the Transactions of the Royal Society ('Phil. Trans.,' vol. 145). They had been previously applied to the case of chemical equilibrium investigated by Professor Dixon in a paper published in vol. 175 of the Transactions of the Royal Society, the reactions in that case being

$$H^2O + CO = H^2 + CO^2,$$
$$H^2 + CO^2 = H^2O + CO.$$

The following Papers were also read:—

I. "On the new Gas obtained from Uraninite. Second Note." By J. Norman Lockyer, C.B., F.R.S. Received May 8, 1895.

Since my communication on the gas obtained from uraninite (bröggerite) was sent into the Society, on the 25th ultimo, I have been employing the method I there referred to in several directions, among them to determine whether the spectrum of the gas indicates a simple or a complex origin.

I was led to make this special inquiry on account of the difference in the frequency of the appearance of D_3 and the other lines to which I referred in the previous communication in the solar chromosphere. For instance, if we take the lines D_3, 4471, and 4302, the frequencies are as follows, according to Young*:—

* See 'Solar Physics,' Lockyer, p. 612.

D_3	100 (maximum)
4471	100 „
4302	3

Hence we might be justified in supposing that D_3 and 4471 are produced by the same gas, while it was probable that 4302 owed its origin to a different one.

But further experiment has given me one case in which D_3 shows bright, while 4471 is entirely absent. I may now add that an equally important line to 4471, one at 4026·5, with the dispersion employed, appears in the spectrum of bröggerite, and both these lines are wide and fluffy, like the lines of hydrogen, and are apparently reversed.

The line 4026·5 has not been recorded by Young, though, as I have stated, the frequency of appearances of 4471 represents the maximum; still, while this is so, the intensity of both these lines in the spectra of the hottest stars is not surpassed even by those of hydrogen. Hence, opinion as to their representing the same gas must be suspended.

Further, I have photographed a line at 4388, apparently coincident with another important line in the same stars. Whether coming from one source or two, in these three lines seen along with D_3 in the gas obtained by me from bröggerite, we have, it would seem, run home the most important lines in the spectra of stars of Group III, in which stars alone we find D_3 reversed. Should these results be confirmed, the importance of the gas or gases they represent, at a certain stage of the evolution of suns and planets, will be gathered from the photograph of Bellatrix, accompanying the following Third Note.

Another case is afforded by a line a λ 667; this is associated with D_3 in bröggerite and clèveite, but the yellow line has been seen in monazite *without* λ 667. It is almost certain, then, that these two lines represent two gases. Certainty cannot be arrived at till a larger quantity of gas has been obtained.

Again the red line at λ 6575, close to C, referred to in my previous communication, is seen both in gummite and bröggerite, but in one case (gummite) it is seen without D_3, and in the other with it; in one case (bröggerite) without λ614, and in the other with it. The above conclusions hold here also.

This line λ 614, possibly coincident with a chromospheric line, has been recorded in gummite and bröggerite. It has been seen *with* D_3 (in bröggerite) and *without* it (in gummite).

I have said enough to indicate that the preliminary reconnaissance suggests that the gas obtained from bröggerite, by my method, is one of complex origin.

I now proceed to show that the same conclusion holds good for the gases obtained by Professors Ramsay and Clève from clèveite.

For this purpose, as the final measures of the lines of the gas as obtained from clèveite by Professors Ramsay and Clève have not yet been published, I take those given by Crookes,* and Clève,† as observed by Thalén. These are as follows, omitting the yellow line :—

Crookes.	Thalén.
	6677
568·05	
566·41	
516·12	
	5048
	5016
500·81	
	4922
480·63	
	4713·5

The most definite and striking result so far obtained is that in the spectra of the minerals giving the yellow line I have so far examined, I have never once seen the lines recorded by Crookes and Thalén in the blue. This demonstrates that the gas obtained from certain specimens of clèveite by chemical methods is vastly different from that obtained by my method from certain specimens of bröggerite, and since, from the point of view of the blue lines, the spectrum of the gas obtained from clèveite is more complex than that of bröggerite, the gas itself cannot be more simple.

Even the blue lines themselves, instead of appearing *en bloc*, vary enormously in the sun, the appearances being—

4922 (4921·3) = 30 times.
4713 (4712·5) = twice.

These are not the only facts which can be adduced to suggest that the gas from clèveite is as complex as that from bröggerite, but while, on the one hand, the simple nature of the gases obtained by Professors Ramsay and Clève, and by myself, must be given up, reasoning on spectroscopic lines, the observations I have already made on several minerals indicate that the gases composing the mixtures are by no means the only ones we may hope to obtain.

This part of the inquiry will be more specially considered in a subsequent communication.

I may remark in conclusion, that in this preliminary inquiry no

* 'Nature,' vol. 51, p. 544.

† 'Comptes Rendus,' April 16, p. 835.

attempt has been made to separate the possibly new gases from the known ones which come over with them; hence, the lines are in some cases very dim, and the application of high dispersion is impossible. The wave-lengths therefore, especially in the visible spectrum, are approximations only; but the view that we are really dealing with gases operative in the solar atmosphere, like the helium which produces D_3, is strengthened by the fact that of the sixty lines so far recorded as new in the various minerals examined, about half occur near the wave-lengths assigned to chromospheric lines in Young's table. I am aware that most of the chromospheric lines have been recently referred to as due to iron,* but I believe this result does not depend upon direct comparisons, and it is entirely opposed to the conclusions to be drawn from the work of the Italian observers, as well as from my own.

II. "On the new Gas obtained from Uraninite. Third Note." By J. Norman Lockyer, C.B., F.R.S. Received May 9, 1895.

In my preliminary note communicated to the Royal Society on the 25th ult., I gave the wave-lengths of the lines which had been observed both at reduced and at atmospheric pressure in the gas (or gases) produced by the method to which I then referred of heating the uraninite mineral (bröggerite) *in vacuo*.

As a short title in future, I shall term this the distillation method.

Since then the various photographs obtained have been reduced, and the wave-lengths of the lines in the structure spectrum of hydrogen observed beyond the region mapped by Hasselberg. I have further observed the spectra of other minerals besides uraninite for the purpose of determining whether any of them gave lines indicating the presence of the gas in uraninite or of other gases.

I now give a table of the lines so far measured in the spectra of eighteen minerals between λλ 3889 and 4580 (Rowland), the region in which, with the plates employed, the photographic action is most intense.

On this table I may remark that of the lines given in my paper of April 25, the final discussion has shown that the following lines are hydrogen structure-lines in the region beyond that mapped by Hasselberg, λλ 4479, 4196, 4156, and 4152·5. The line 4368 is also omitted from this list as it has not been finally determined whether it coincides with a line of oxygen.

In the table, besides the wave-lengths on Ångström's and Rowland's scale, I give lines which have been observed in the sun's

* Scheiner's 'Astronomical Spectroscopy,' Frost's translation, p. 184.